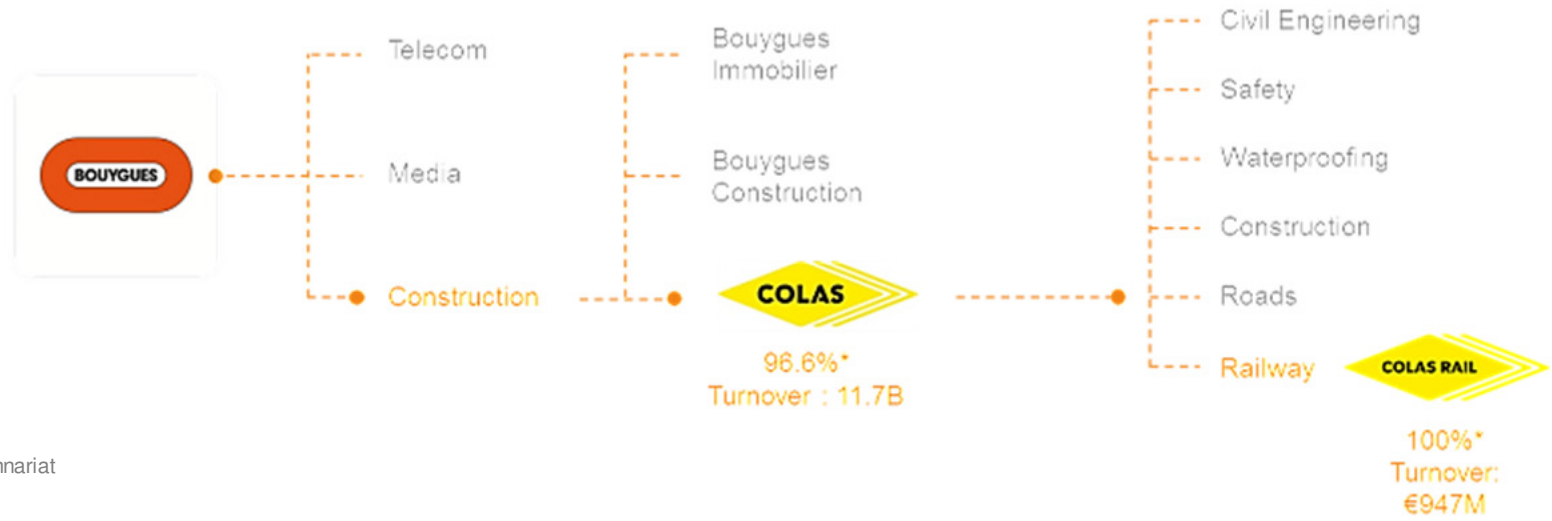
ÖVG-KONGRESS FAHRSTROMANLAGEN
HIGH SPEED PROJECTS IN ITALY - ELECTRIFICATION SYSTEM

9th October 2018

COLAS RAIL
ITALIA

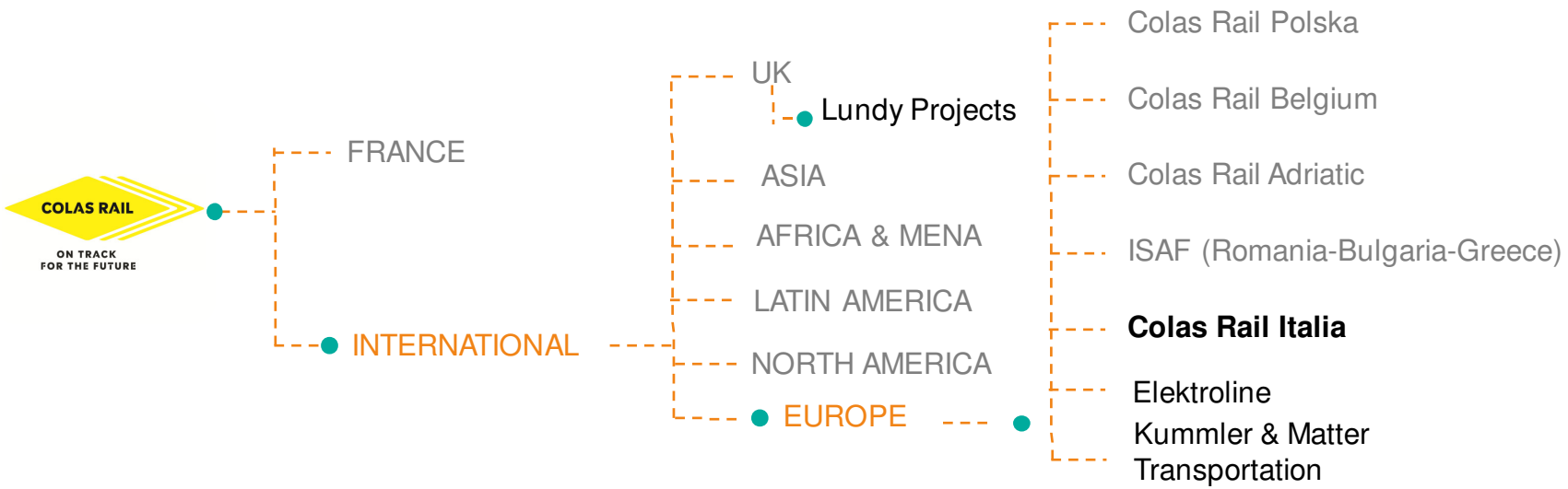
COLAS RAIL ITALIA

- On 1 August 2018 Colas Rail acquires the **Italian rail electrification** and infrastructure business of Alpiq
- The Company is now named Colas Rail Italia S.p.A

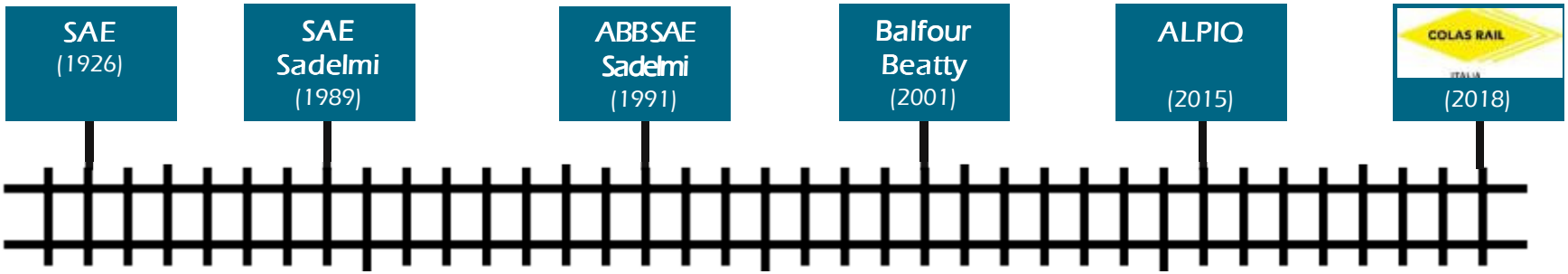


*Actionnariat

GROUP ORGANIZATION



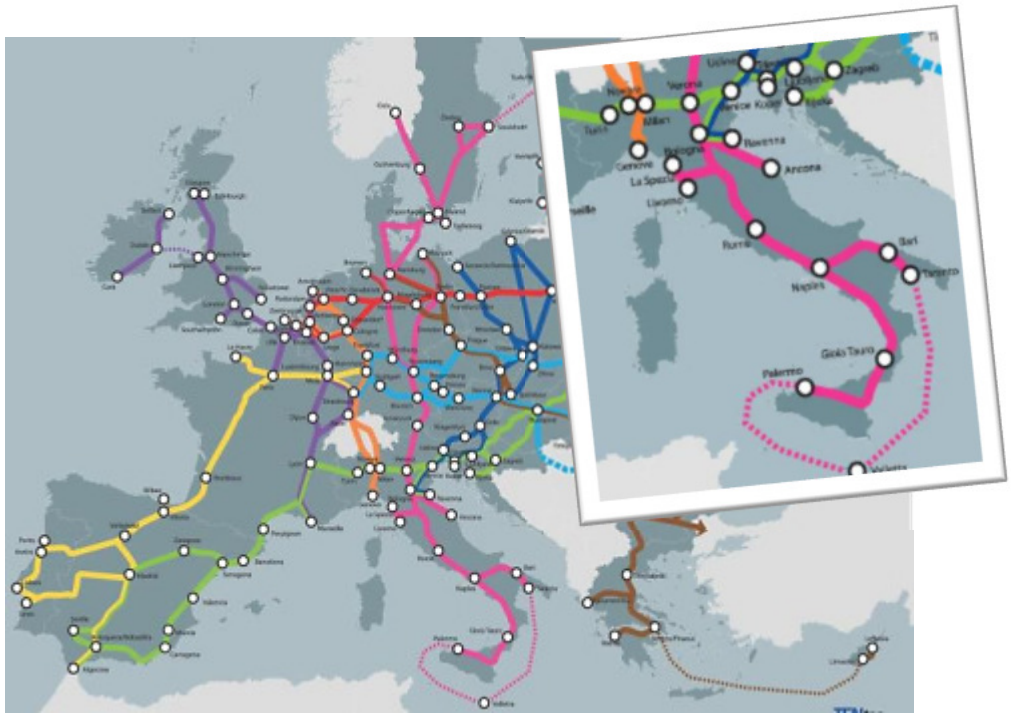
COMPANY HISTORY



- Colas Rail Italia operates as an **international railway infrastructure contractor** offering specific technological solutions and developing multidisciplinary projects.
- One of the oldest and successful Italian Rail Electrification Companies – **over 30,000 km of electrified railway lines** in Italy and overseas since the date of establishment (1926).
- One of the top turnkey railway electrification players in Italy – **first rank in Catenary Works**.
- Multi-disciplinary capabilities for High Speed Lines and EPC Rail projects.
- In house Engineering Capabilities.

HIGH SPEED BACKBONE IN ITALY

Core Corridor - TENT-T Network



Of the nine core corridors that form the **backbone of the Trans European Network-Transport**, **four involve Italy**, crossing it from north to south and from west to east:

- The BALTIC-ADRIATIC
- The SCANDINAVIAN-MEDITERRANEAN
- The RHINE-ALPS

In Italy:

- More than 1,100 km long
- That can be thought of as a big "T"

HS LINES IN OPERATION (STAGE ONE)

Turin - Milan
Turin-Novara, in operation Feb. 2006
Novara-Milan, in operation Dec. 2009

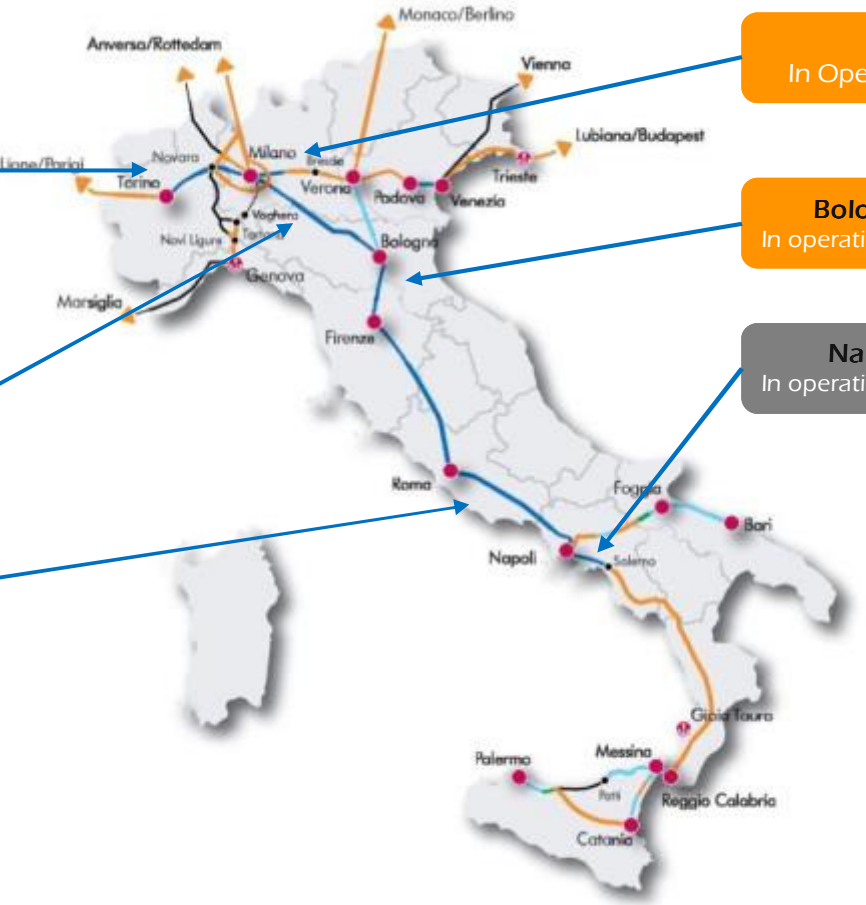
Milan - Bologna
In operation Dec. 2008

Rome - Naples
1 Lot, in operation Dec 2005
2 Lot, in operation Dec. 2008

Treviglio – Brescia
In Operation since 12 Dec. 2016

Bologna - Florence
In operation Dec. 2009

Naples - Salerno
In operation Dec. 2007



In progettazione > *Planning stage*
In costruzione > *Construction stage*
In esercizio > *Operational*
In esercizio > *Operational*
(linee veloci fino a 250 Km/h) > (fast lines at 250 Km/h)

COLAS RAIL contracts

Source: rete Ferroviaria Italiana

COLAS RAIL
ITALIA

KEY FEATURES OF THE ITALIAN HIGH SPEED LINE

Design speed	300 – 360 km/h
Operational speed	300 km/h
Minimum curve	5,450 m
Max Gradient – surface	18 ‰
Max gradient – in tunnels	15 ‰
Distance between tracks	4.5 - 5 m
Max axle load	25 t
Rails	UIC 60
Distance between shunting / recovering points	48 km
Distance between cross-over points	24 km
Distance between power substations	50 km
Minimum headway	2 ' 30"
Design headway fro power supply	5 '
Power supply (open line)	2x25kV - 50 Hz
Power supply in junction area	3 kV dc

Full conformity of sub-systems with the **European Technical Specifications for Interoperability** for the main characteristics:

- ELECTRIFICATION: 2x25kV
- HV power supply 132-150kV
- SIGNALLING: ERMTS Level 2

SYSTEM INTEGRATOR FOR THE HS TECHNOLOGIES IN ITALY

Consorzio SATURNO,
Top railway's technology nationally and internationally

- Established in **1989.**
- Nominated subcontractor by Italian State Railways, the **unique technological partner for the first phase of Italian HS design and build.**
- Preliminary and construction engineering, supply, installation, system integration and commissioning.
- One leading partner for each technology.

Colas Rail Italia, Leading Technological Partner for
- **Overhead Contact Line**
- **Overhead Transmission Lines**
- **Traction Power Substations** (with other partners)

HIGH VOLTAGE POWER SUPPLY

HIGH VOLTAGE POWER SUPPLY

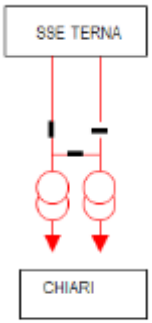
- HV power supply from public utility, 132 or 150kV
- Poles: Enel /Terna standard or compact type
- Original feeding strategy:

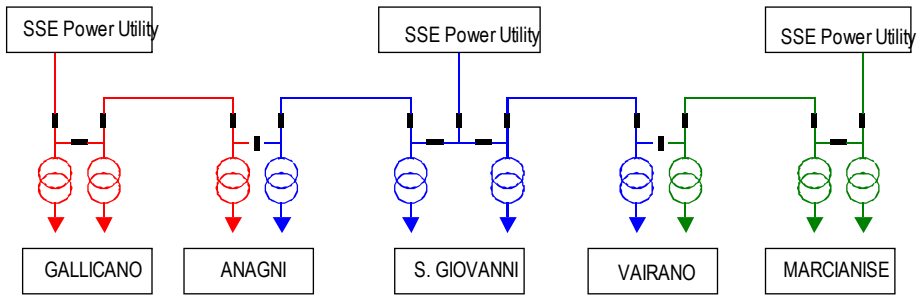
  Dedicated HV three-phase network

  Single circuit with back-up feedings from other nodes
- Actual choice:

  Point to point feeding from public utility network

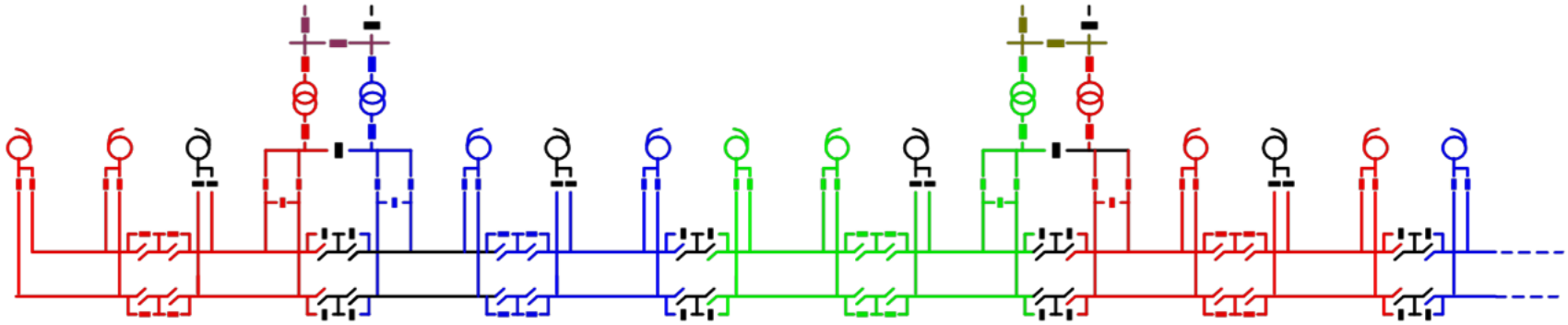
  Double circuit





2X25 KV POWER SUPPLY TRACTION SUBSTATIONS

2X25 KV POWER SUPPLY - TRACTION SUBSTATIONS



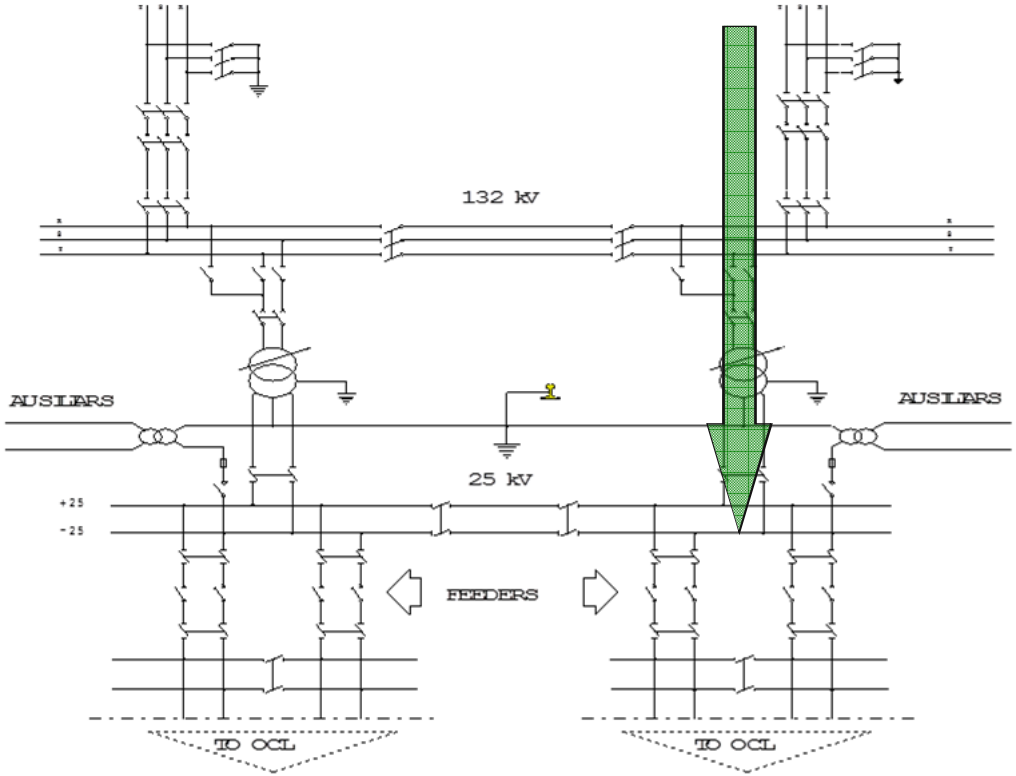
- Substations are spaced at intervals of **50 km**
- **Three autotransformer stations**, evenly spaced, are placed between them
- Substations and sectioning points are **equipped with a Command, Control, Protection and Diagnostic** controlling the whole equipment

2X25 KV POWER SUPPLY - TRACTION SUBSTATIONS

Main data

HIGH VOLTAGE LEVEL	**kV 132-150**
MEDIUM VOLTAGE LEVEL	**kV 25**
TPS TYPE	**AIS/GIS**
HV CONNECTION	**V-Type**
POWER INSTALLED	**MVA 2x60**
TRANSFORMER DUTY CICLE	**MVA 60/90/120** Cont/15'/5'
MAX SHORT CIRCUIT AT HV BUSBAR	**kA12,5**
MAX SHORT CIRCUIT AT MV BUSBAR	**kA 11**
AUXILIARY TRANSFORMER	**kVA 2x100 by substation** **kVA 30 back-up (by utility)**
NUMBER OF FEEDER	**4 Normal**

PROTECTION SCHEMA (ANSI CODE)	Normal	Back up
HV INCOMING	**50-51**	
HV INCOMING -OUTGOING	**21**	**50-51**
TRANSFORMER * plus transformer onboard 97-99-26-49	**87***	**50-51**
FEEDER	**21**	**50-51**
AUXILIAR TRANSFORMER	**fuse**	



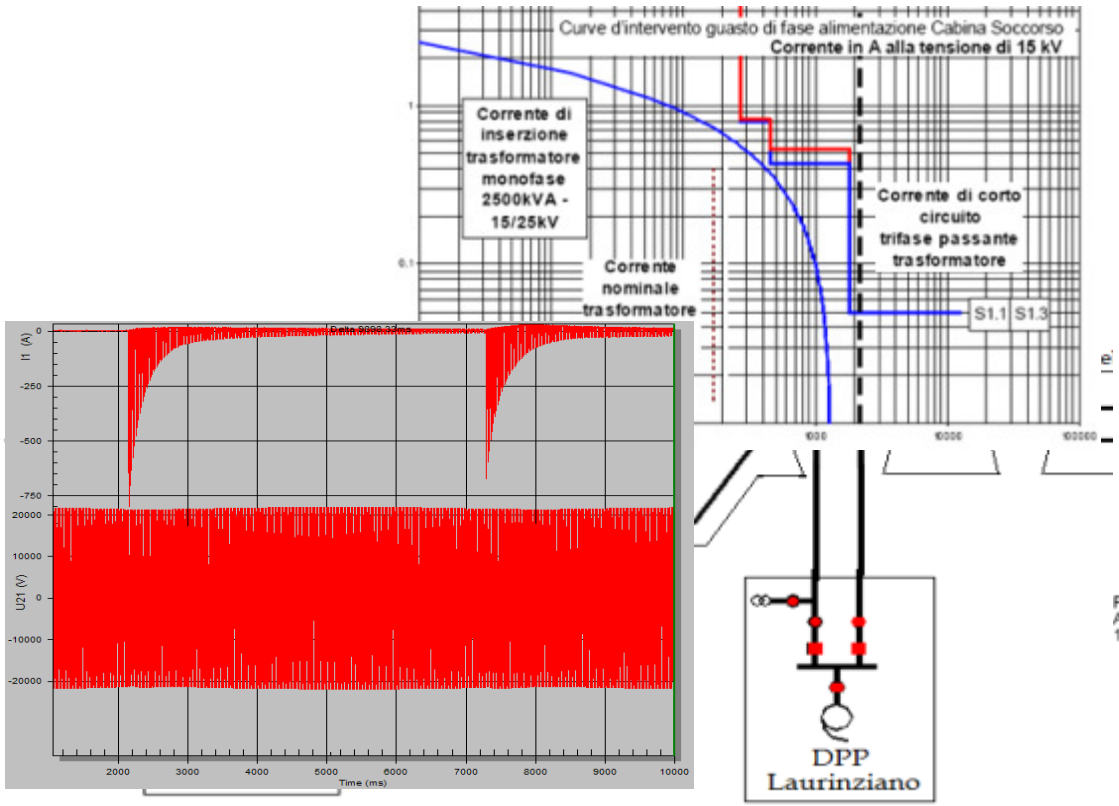
2X25 KV POWER SUPPLY - TRACTION SUBSTATIONS

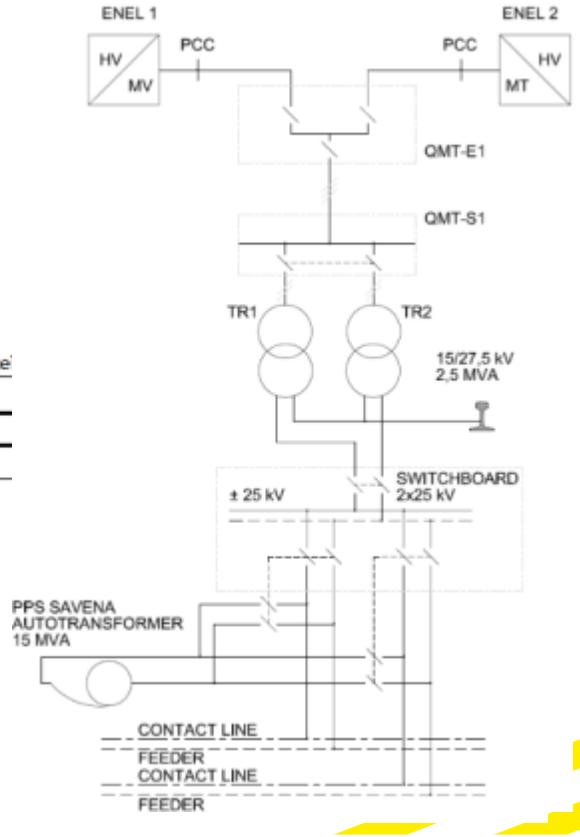
Main data

LAYOUT	m 90 x 70 - Typical fro AIS	m 50 x 30 - Typical for GIS
BUILDING	m 13 x 7	
SURFACE FINISHING	Asphalt	
COMMAND & CONTROL	▪ Independent systems ▪ SCADA for local control ▪ RTUs for remote control	

2X25 KV POWER SUPPLY - BACK-UP AND EMERGENCY FEEDINGS

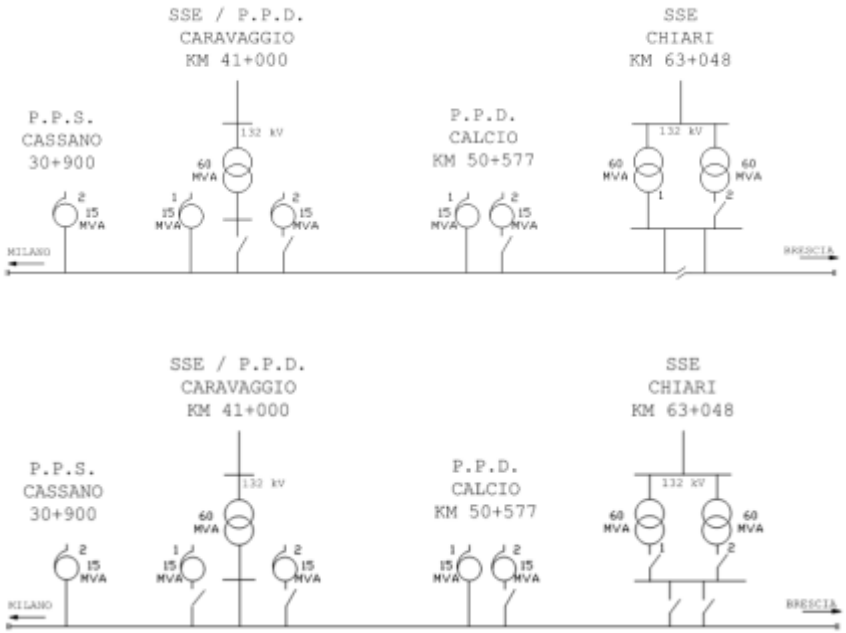
HS Bologna to Florence – Auto Transformers Station at Savena

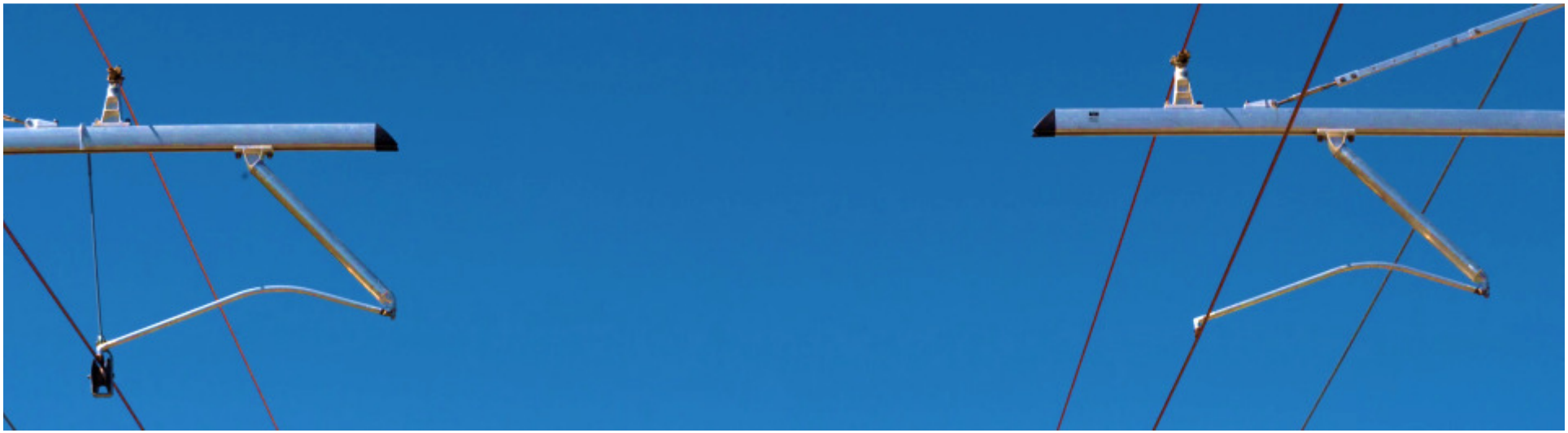




2X25 KV POWER SUPPLY - BACK-UP AND EMERGENCY FEEDINGS

HS Milano to Brescia – ATS Caravaggio





2X25 KV OVERHEAD CONTACT LINE

2X25 KV OVERHEAD CONTACT LINE

Main data

CATENARY WIRE	1 x 120mm², Cu ETP, 16,25 kN
CONTACT WIRE	1 x 150mm², Cu ETP, 20 kN
DROPPERS	16mm² Bz II (DIN 43138) conductive
FEEDER	1 x 307,7mm², aluminum-steel
AERIAL EARTH WIRE	1 x 147mm², aluminum
BURIED CURRENT COLLECTOR	1 x 95mm², Cu ETP
MAX SPAN LENGTH	60 m
MAX TENSION LENGTH	1400 m
INSULATED / UNINSULATED OVERLAP	4 spans configuration
NEUTRAL SECTION	▪ 5 spans configuration ▪ "split neutral section" configuration as per EN 50367 ▪ interoperable according to TSI

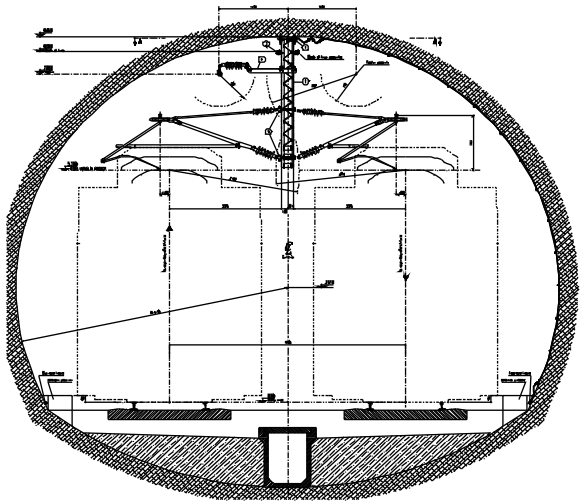
2X25 KV - OVERHEAD CONTACT LINE

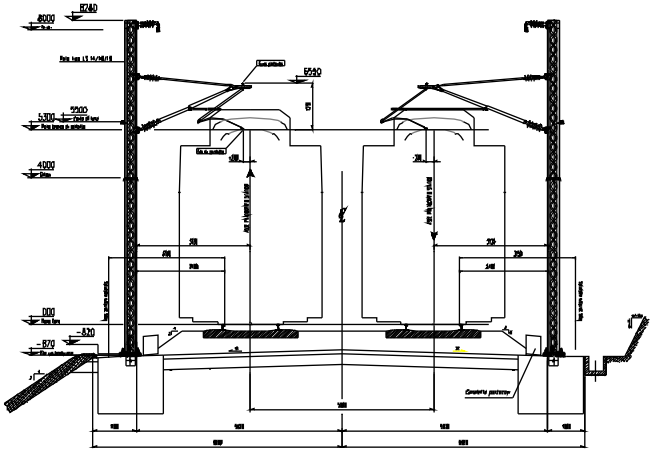
Main data

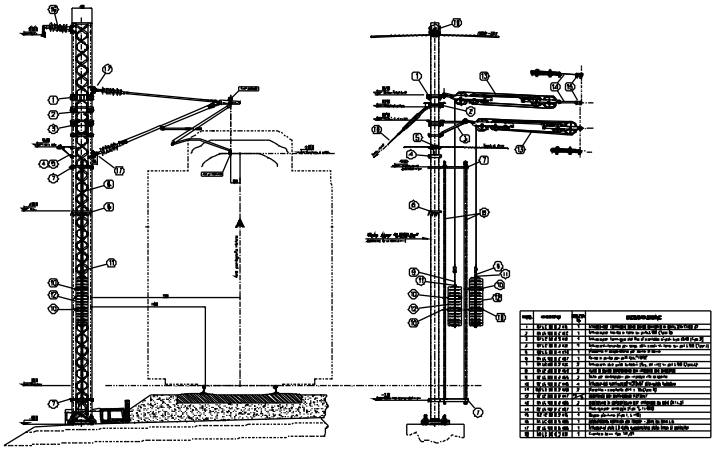
MASTS	LS series (double channel type)
PORTALS	lattice structures with different spans (up to 27 m)
CONNECTION OCL SUPPORTS - FOUNDATION	by means of anchor bolts
CANTILEVER	aluminum type
INSULATORS	fiberglass rod + silicone rubber
TENSIONING DEVICE	ratio 1:5; five pulleys in-line
MID POINT ASSEMBLY	▪ fiberglass rods connecting catenary wire and contact wire ▪ steel ropes connecting catenary wire and masts

2X25 KV - CONTACT LINE

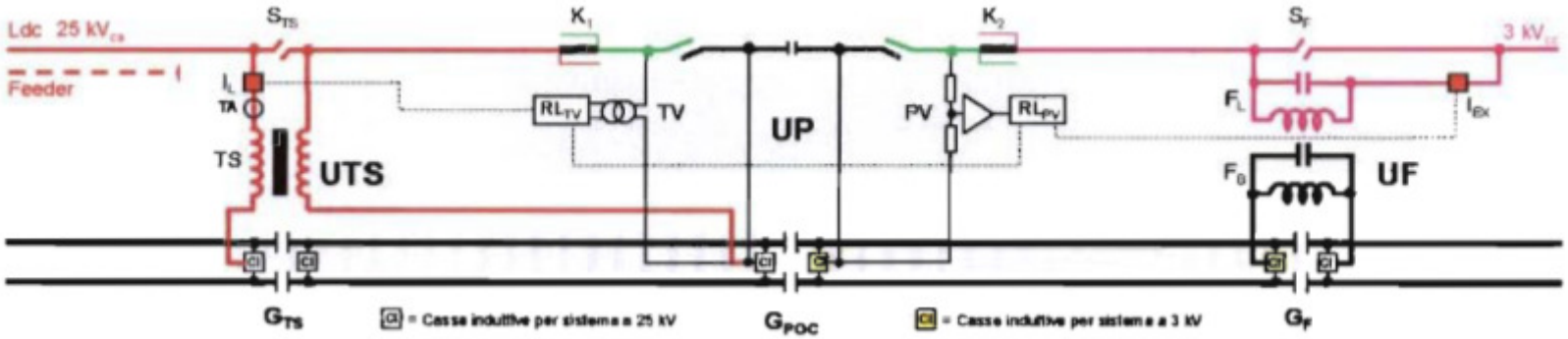
- Typical cross section with LS masts
- Embankment / cutting
- Tunnel (single tube)
- Anchoring point







2X25 KV – 3KV AC/DC SYSTEM SEPARATION SECTION



- The system separation section allows the train to **switch its supply system**, while running and in a fully automatic way
- Electrical configuration: **25 kV approach section + 25 kV switched off section + earthed section + 3 kV switched off section + 3 kV approach section**
- Approach sections: they can be switched off in case the automatic switching device doesn't work and the pantograph trespasses the "border" between the two systems; they are connected to "open line" sections by means of:
  - 25 kV: circuit breaker and transformer/separator
  - 3 kV: circuit breaker and filters

2X25 KV OVERHEAD CONTACT LINE
UPGRADES TO IMPROVE PERFORMANCES AND MAINTAINABILITY

2X25 KV CONTACT LINE
UPGRADES ON MATERIALS, COMPONENTS AND ARRANGEMENTS TO IMPROVE PERFORMANCES AND MAINTAINABILITY

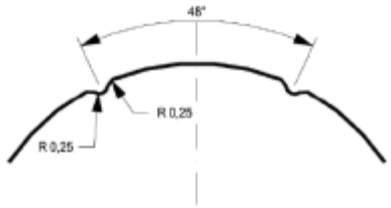
1. Contact wire – CuAg or CuMg
2. Earth wire – TACSR
3. Cantilever – OMNIA
4. Out of running wires – taking-up device
5. Tensioning device – fall arresting device
6. Mid point assembly
7. Design speed increase,:
   - up to 360 km/h for 25kV lines
   - up to 300 km/h for 3 kV lines

1. CONTACT WIRE – CUAG OR CUMG

Contact wire – CuAg instead of CuETP

TARGET: better features in terms of creep behavior and maximum allowable temperature

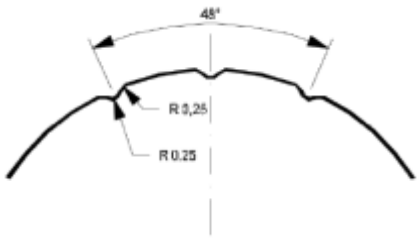
Upper lobe of CuAg contact wire: two grooves



Contact wire – CuMg instead of CuETP

TARGET: better features in terms of creep behaviour, maximum allowable temperature and maximum breaking load -> contact wire tensioned at 30 kN (+50% against standard OCL)

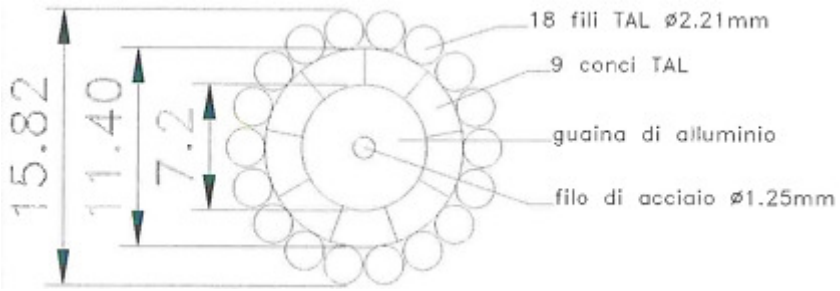
Upper lobe of CuMg contact wire: three grooves



2. EARTH WIRE – TACSR INSTEAD OF ALUMINUM

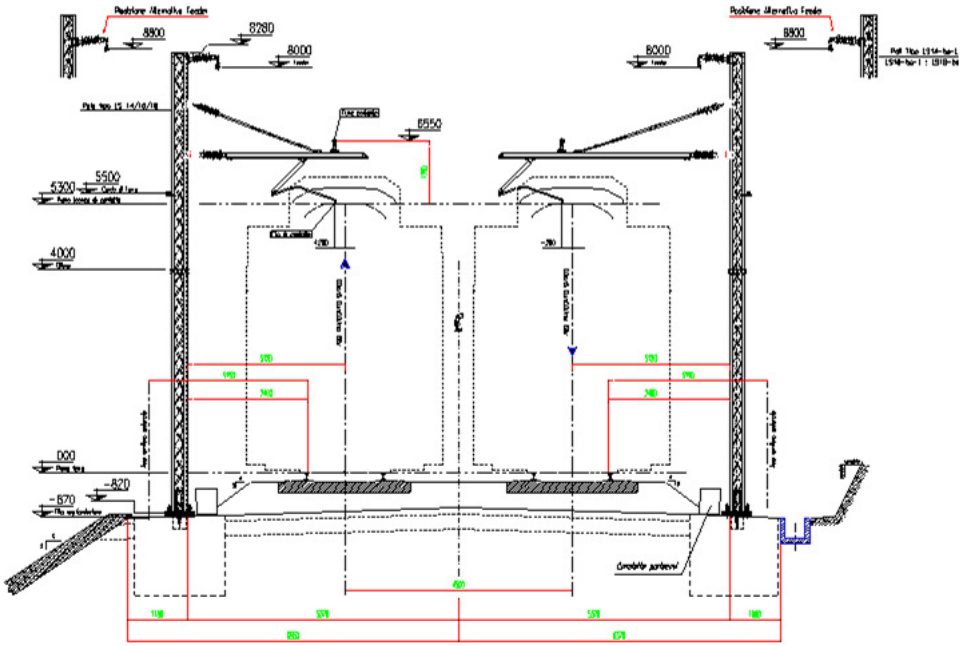
TARGET: standardization with traditional 3kV lines and theft protection

MAIN FEATURES	
MATERIAL	**Aluminun / steel**
OVERALL NOMINAL SECTION	**170 mm²**
MASS	**0,486 kg/m**
BREAKING LOAD	**23,35 kN**



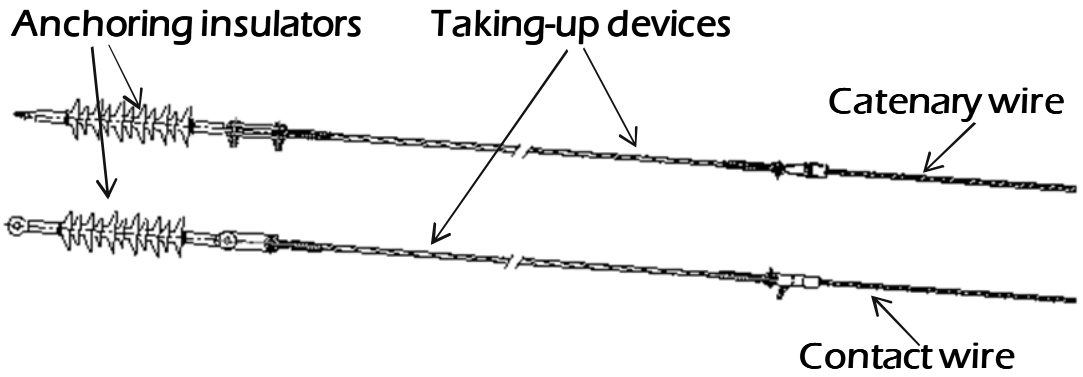
3. CANTILEVER – OMNIA

TARGET: maintenance improvement and standardization with traditional 3kV lines



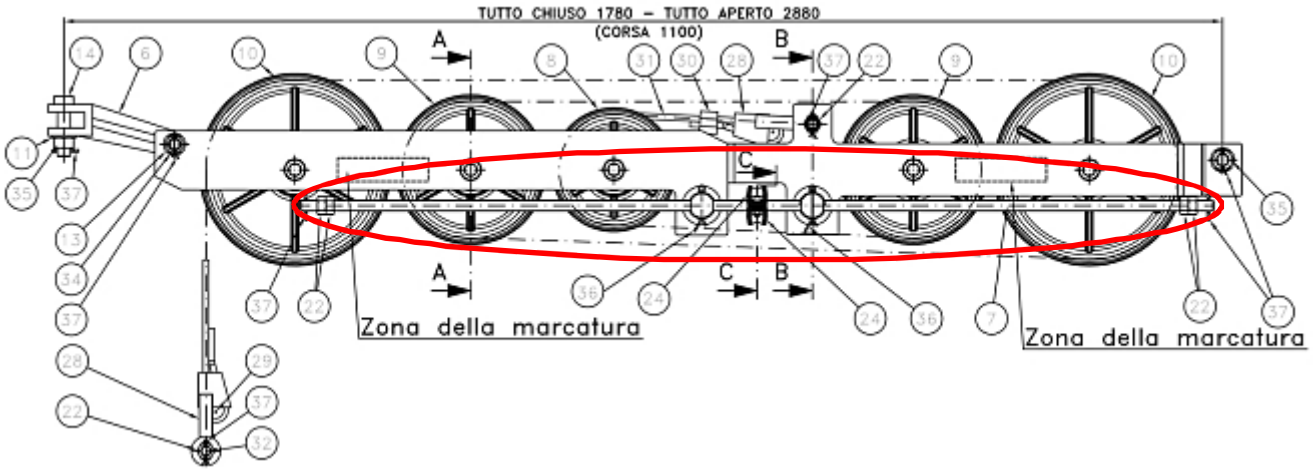
4.OUT OF RUNNING WIRES – TAKING-UP DEVICE

TARGET: maintenance improvement



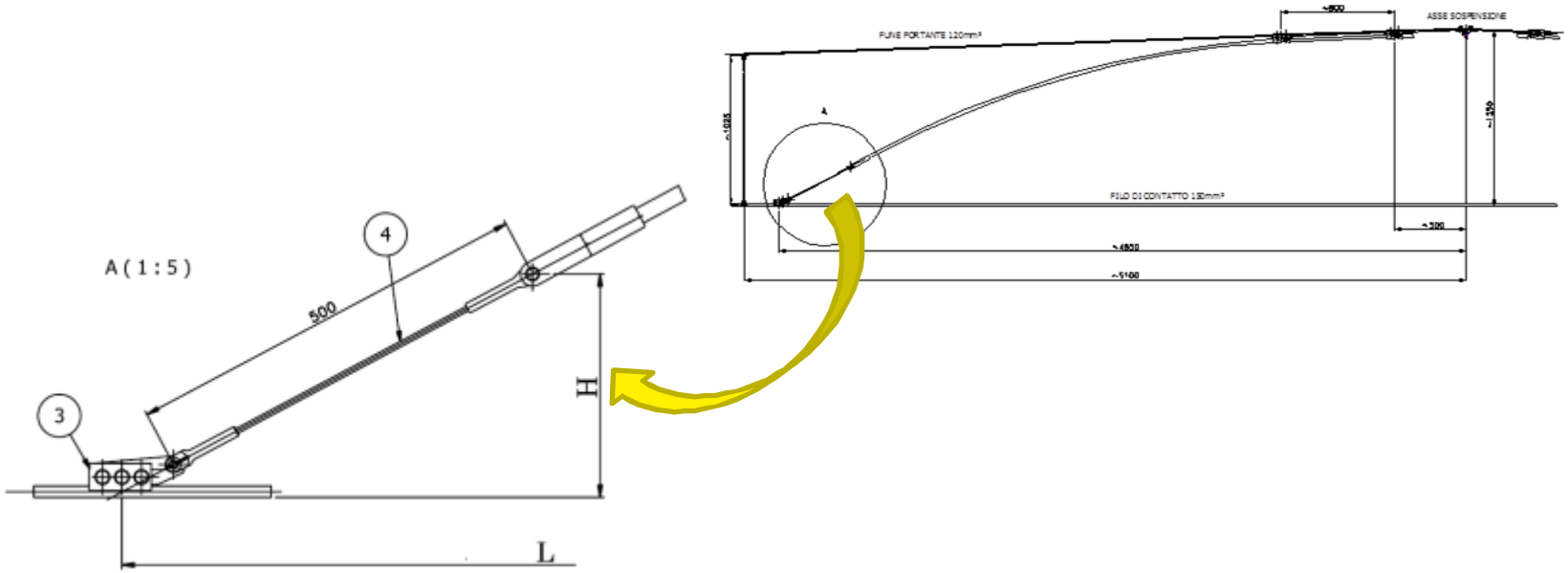
5. TENSIONING DEVICE – FALL ARRESTING DEVICE

TARGET: improved behavior in case of contact wire breakdown



6. MID POINT ASSEMBLY

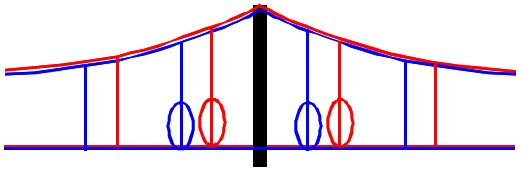
TARGET: elasticity improvement

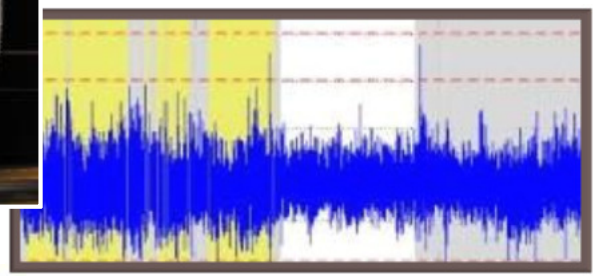


7. DESIGN SPEED INCREASE

Up to 300 km/h for 3 kV lines

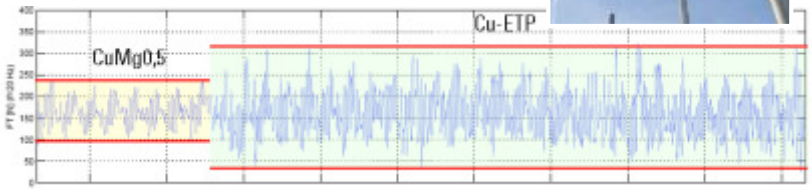
- CuAg 0,1
- contact wire tensioning increase to 22,5 kN
- Different configuration of overlaps (vertical arrangement)
- Damping droppers





Up to 360 km/h for 25kV lines

- CuMg 05
- tensioning increase for the wire to 30 kN
- New counterweight
- New arrangement for neutral section



THANK YOU.

- Colas Rail Italia S.p.A. – Via Lampedusa 13/F 20141 Milano (IT) – T. +39 02 89536,100
- giuseppe.ghilardi@colasrail.com